

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC**

In the Matter of)	
)	
Rural Digital Opportunity Fund)	WC Docket No. 19-126
)	
Connect America Fund)	WC Docket No. 10-90

COMMENTS OF THE FIBER BROADBAND ASSOCIATION

Lisa R. Youngers
President and CEO
Fiber Broadband Association
Suite 800
2025 M Street NW
Washington, DC 20036
Telephone: (202) 367-1236

September 20, 2019

TABLE OF CONTENTS

INTRODUCTION AND SUMMARY	1
I. THE CAF II PERFORMANCE TIER DISCOUNTS DID NOT MAXIMIZE THE FCC’S BUDGET AND THE DEPLOYMENT OF HIGH-SPEED, LOW LATENCY SERVICES.....	3
II. TO MAXIMIZE THE RDOF BUDGET AND THE DEPLOYMENT OF HIGH-SPEED, LOW LATENCY SERVICES, THE COMMISSION SHOULD ADOPT DISCOUNTS THAT REFLECT THE RELATIVE BENEFITS OF EACH PERFORMANCE TIER	6
CONCLUSION.....	13

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC**

In the Matter of)	
)	
Rural Digital Opportunity Fund)	WC Docket No. 19-126
)	
Connect America Fund)	WC Docket No. 10-90

COMMENTS OF THE FIBER BROADBAND ASSOCIATION

INTRODUCTION AND SUMMARY

The Fiber Broadband Association (“FBA”)¹ hereby submits these comments in response to the Federal Communications Commission’s (“FCC” or “Commission”) Notice of Proposed Rulemaking (“NPRM”) in the above-captioned proceeding establishing the Rural Digital Opportunity Fund (“RDOF”) and seeking comment on its framework, including whether its weighting methodology will achieve the Commission’s goals to “encourage the deployment of higher speed services” or whether the Commission should adopt an alternative weighting methodology that “balance[s] the objectives of maximizing [the Commission’s] limited budget and guard[s] against widening the digital divide by ensuring that rural Americans do not fall further behind those living in urban areas.”² FBA applauds the Commission’s effort to build on

¹ FBA is a not for profit trade association with more than 250 members, including telecommunications, computing, networking, system integration, engineering, and content-provider companies, as well as traditional service providers, utilities, and municipalities. Its mission is to accelerate deployment of all-fiber access networks by demonstrating how fiber-enabled applications and solutions create value for service providers and their customers, promote economic development, and enhance quality of life. A complete list of FBA members can be found on the organization’s website: <https://www.fiberbroadband.org/>.

² *Rural Digital Opportunity Fund; Connect America Fund*, WC Dkts. 19-126, 10-90, Notice of Proposed Rulemaking, FCC 19-77, ¶¶ 25, 27 (rel. Aug. 2, 2019) (“NPRM”).

the success of the Connect America Fund Phase II (“CAF II”) auction³ and further support the deployment of modern, high-speed communications networks to unserved consumers.

When the Commission established its weighting methodology for the CAF II auction, its goals were to make the most efficient use of its limited budget by maximizing auction participation to drive down prices and reflect the value of higher tier and lower latency services. To analyze whether the CAF II auction in fact met these goals, FBA commissioned a study by the business consulting firm Cartesian.⁴ As discussed herein, Cartesian found that the Commission’s weighting methodology did not maximize participation in the auction, especially among gigabit tier providers. As a result, bidding in the auction was not as competitive as it could have been, and thus the Commission provided more support than optimal to winning bidders.

Just as with the CAF II auction, the RDOF auction also seeks to “prioritize faster, gigabit speeds,” while ensuring that support is awarded cost-effectively.⁵ Because the performance tier

³ Connect America Fund et al., WC Docket Nos. 10-90, 14-58, Report and Order and Order on Reconsideration, 32 FCC Rcd 1624 (2017) (“CAF II FNPRM Order”).

⁴ Cartesian is a consulting firm specialized in the technology, media and telecom (TMT) sector. It analyzes data and builds models for, and provides strategic advice to, communications providers to assist them in network planning, operations, and marketing.

⁵ NPRM at ¶¶ 12, 14. Chairman Pai has also frequently expressed the value of gigabit deployments:

- In 2016, he called for the creation of “Gigabit Opportunity Zones” to spur deployment of gigabit networks to low-income neighborhoods. Remarks of Commissioner Ajit Pai, *A Digital Empowerment Agenda*, The Brandery (Sep. 13, 2016), <https://docs.fcc.gov/public/attachments/DOC-341210A1.pdf>.
- In 2018, he championed rule changes that would reduce barriers to deploying such networks. *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment, Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Dkt. No. 17-84, WT Dkt. No. 17-79, 33 FCC Rcd 7705, 7818 (rel. Aug. 3, 2018).

discounts in the CAF II auction did not result in the most cost-efficient outcome, FBA asked Cartesian to develop a non-arbitrary weighting methodology that would achieve the Commission's goals. Cartesian recommended a methodology based on the relative difference in the consumer benefits produced by each performance tier, which it first calculated and then translated into weights for each performance tier. According to this methodology, the discounts from the gigabit tier to the baseline low latency and baseline high latency tiers should be 70 points and 85 points, respectively. Cartesian finds these discounts will maximize participation, the Commission's budget, and the deployment of gigabit services, which will ensure rural Americans can access critical benefits and keep pace with their urban counterparts.

I. THE CAF II PERFORMANCE TIER DISCOUNTS DID NOT MAXIMIZE THE FCC'S BUDGET AND THE DEPLOYMENT OF HIGH-SPEED, LOW LATENCY SERVICES

When the Commission established the CAF II performance tier discounts, it said that the weights “attempt to leverage [the Commission's] finite budget to achieve speeds that are scalable to meet the evolving needs of consumers over the 10-year term.”⁶ To maximize the budget, the Commission said that “every bidder—no matter the service tier or latency—must have the opportunity to exert competitive pricing pressure on every other bidder.”⁷ To achieve scalable

-
- In June 2019, Chairman Pai touted the increase in greenfield gigabit speed build outs in 2018. Press Release, *Statement of Chairman Pai on Increased Broadband Investment for Second Year in a Row* (June 10, 2019), <https://docs.fcc.gov/public/attachments/DOC-357892A1.pdf>.
 - In Chairman Pai's statement accompanying the NPRM, the Chairman recognized how an award from the CAF II auction helped an electrical co-op build a gigabit-speed network, calling for “similar results on an even greater scale from the Rural Digital Opportunity Fund.” NPRM at 58.

⁶ CAF II FNPRM Order at 1629.

⁷ *Id.* at 1630.

speeds, the Commission said the weights “should strive to reflect the value of higher-speed and lower-latency services to consumers.”⁸

FBA commissioned Cartesian to analyze the CAF II auction’s results to determine if the performance tier discounts maximized the Commission’s budget and reflected the value of higher-speed and lower-latency services to consumers.⁹ While the auction awarded support significantly below the reserve prices to bring higher performance broadband service to unserved areas, the study found that a greater point spread between the higher and lower performance tier discounts would have resulted in lower winning bids, more locations served, and higher performance service at each location.¹⁰ In short, the Commission could have gotten more bang for its buck.

According to the study, “the weights did not maximize participation in the auction, especially from providers that could offer the highest performance gigabit service, and thus did not distribute support most efficiently.”¹¹ Specifically, 80% of locations in the auction did not receive bids from gigabit providers, and less than 2.4% received bids from two or more gigabit providers.¹² Ultimately, only 19% of locations were awarded at the gigabit performance tier.¹³

⁸ *Id.*

⁹ Prior to the CAF II auction, ACA expressed concern that the discounts set by the Commission would not maximize participation. Reply Comments of ACA at 4 (filed Aug. 5, 2016); Letter from Thomas Cohen, Counsel to the American Cable Association, to Marlene H. Dortch, Secretary, FCC, at 2 (filed Feb. 6, 2017).

¹⁰ Appendix A: Cartesian Weighting Study at 2.

¹¹ *Id.*

¹² *Id.* at 4.

¹³ *Connect America Fund Phase II Auction Results*, Rural Broadband Auctions Task Force, FCC (Sep. 26, 2018), <https://docs.fcc.gov/public/attachments/DOC-354278A1.pdf> (“CAF II Auction Results”).

While the Commission intended for its performance tier discounts to “giv[e] all service providers the opportunity to place competitive bids, regardless of the technology they intend to use to meet their obligations,”¹⁴ that turned out not to be the case for gigabit providers in most locations. The study indicates that gigabit tier providers concluded that they did not have a reasonable chance to win at a price that gave them an adequate business case for deploying their service. In other words, the discounts used by the Commission did not adequately reflect the value of each performance tier.¹⁵

The study also found that, among the gigabit providers that did participate in the auction, most were electric cooperatives.¹⁶ This is consistent with the conclusion that the discount did not provide an adequate business case for the gigabit tier. Gigabit deployments by electric co-ops represent a uniquely viable business case because co-ops can leverage their existing infrastructure to build their fiber network within their footprint at lower costs.¹⁷ The lower costs allowed them to make bids that were more competitive with providers in other service tiers, increasing their chances of winning. However, other potential gigabit providers lacked similar advantages, did not have a viable business case, and opted not to bid. That is why the vast majority of locations did not receive gigabit tier bids despite co-op participation in the auction.¹⁸

The reduced participation of gigabit tier providers prevented the Commission from achieving its desired goal of maximizing competitive bidding in the auction to drive down prices.

¹⁴ CAF II FNPRM Order at 1633.

¹⁵ It is also the case that the Commission did not properly capture the costs of deploying service at each performance tier.

¹⁶ Appendix A: Cartesian Weighting Study at 4.

¹⁷ *Id.*

¹⁸ See CAF II Auction Results at 4 (showing that 81% of locations in the auction were awarded at either the minimum, baseline, or above baseline tiers).

Instead, the providers that won the auction at lower performance tiers were able to prevail at a higher price than they might have bid had competition been maximized. In short, in many cases, the Commission overpaid support for the winning service.

Since competitive bidding was not maximized, neither was the Commission's budget. Had prices been driven down, the funds saved could have been used to support service in other areas. The Cartesian study concluded that "[i]ncreased participation by other gigabit providers would likely have pushed down ultimate support levels for many locations, thereby increasing the number of locations that [could have been] served within the budget."¹⁹ Additionally, more competition from gigabit tier providers would have increased their opportunity to win, resulting in higher tier service being provided to more consumers.

Because Cartesian's study of the performance tier discounts in the CAF II auction showed that the Commission could have achieved a better outcome, FBA asked Cartesian to develop a weighting methodology that would maximize participation at all tiers, resulting in greater competition and more efficient use of the Commission's budget.

II. TO MAXIMIZE THE RDOF BUDGET AND THE DEPLOYMENT OF HIGH-SPEED, LOW LATENCY SERVICES, THE COMMISSION SHOULD ADOPT DISCOUNTS THAT REFLECT THE RELATIVE BENEFITS OF EACH PERFORMANCE TIER

Just as with the CAF II auction, the RDOF NPRM expresses the Commission's desire that the discounts it uses "reflect [its] preference for higher speeds, higher usage allowances, and low latency."²⁰ Accordingly, the Commission proposes to maintain the "90-point spread between the best and least performing tiers" by increasing the discount of the above baseline tier

¹⁹ *Id.*

²⁰ *NPRM* at ¶ 25.

by 10 points, the baseline low latency tier by 5 points, and the baseline high latency tier by 20 points.²¹ The Commission is seeking comment on whether its new methodology will “encourage the deployment of higher speed services” or whether the Commission should adopt an alternative weighting methodology.²² Commenters proposing alternative methodologies were asked to explain how their proposals would “balance the objectives of maximizing [the Commission’s] limited budget and guarding against widening the digital divide by ensuring that rural Americans do not fall further behind those living in urban areas.”²³ FBA proposes that the Commission increase the discount of lower tier services to better reflect the relative value of the higher tier services. FBA demonstrates below how its methodology will not only maximize the Commission’s budget and close the digital divide but will do so by encouraging deployment of higher speed, lower latency services with significant capacity.

To determine how the Commission could set performance tier discounts to maximize auction participation, FBA asked Cartesian to conduct a bottom-up analysis of the CAF II auction. Based on its analysis, Cartesian was able to develop a non-arbitrary weighting methodology centered on the relative benefits of each performance tier, which ensures “that the ratio of support to benefit is constant across technologies.”²⁴

As the basis for its analysis, Cartesian first identified seven categories of use cases—or benefits—that are available to consumers that have access to broadband internet:

1. **Telecommuting**, *i.e.*, remote work, collaboration over long distances.

²¹ *Id.* The Commission also plans to remove the minimum 10/1 performance tier. *Id.* at ¶ 24.

²² *Id.* at ¶¶ 25, 27.

²³ *Id.* at ¶ 27.

²⁴ Appendix A: Cartesian Weighting Study at 12.

2. **Remote Health & Learning**, *i.e.*, online education, health monitoring and remote communication with teachers and doctors.
3. **E-Commerce**, *i.e.*, online shopping and other remote communication with sellers.
4. **Streaming Video**, *i.e.*, entertainment such as over-the-top video services.
5. **Cloud Storage and Computing**, *i.e.*, remote access to non-local data storage and computing power.
6. **Gaming and Social Media**, *i.e.*, online access to interactive entertainment and social communications.
7. **Two-Way Video Streaming**, *i.e.*, real-time video communication and upload of user-created media.²⁵

Cartesian then calculated the average maximum monetary benefit range per household (“HH”) that corresponds with each use case, when broadband speed is not a constraint, and the sources of those benefits (*see Figure 1*).²⁶ For example, “telecommuting” has an annual household monetary benefit range of \$250-300 from transportation savings and reduced facilities cost while cloud storage and computing has an annual monetary benefit range of \$20-30 from reduced direct spending on computing capacity.²⁷ Cartesian also determined the different connectivity needs for each use case, since services offering slower speeds and higher latency cannot supply the bandwidth for all use cases.²⁸








²⁵ *Id.* at 7.

²⁶ *Id.* at 8.

²⁷ *Id.*

²⁸ *Id.*

Figure 1: Monetary Benefits, Sources, and Connectivity Needs²⁹

Use Case	Est. Annual Benefit / HH	Connectivity Needs	Sources of Benefit
 Telecommuting	\$250-300	Efficient collaboration and low-latency video conferencing	<ul style="list-style-type: none"> • Savings on fuel, vehicle and other transportation costs • Reduced facilities costs
 Remote Health & Learning	\$50-100	Video conferencing with doctor/instructor, web-based tools and applications	<ul style="list-style-type: none"> • Savings on transportation • Reduced direct costs of doctor visits • Reduced educational housing costs
 E-Commerce	\$100-120	Research, comparison shopping and purchasing, including video reviews	<ul style="list-style-type: none"> • Time and cost savings for purchasing decisions • Reduced transportation costs
 Streaming Video	\$20-50	Standard definition and 4K video streaming for entertainment	<ul style="list-style-type: none"> • Reduced transportation costs • Reduced direct spending on video entertainment
 Cloud Storage and Computing	\$20-30	Storage, file syncing, and throughput for remote machine use	<ul style="list-style-type: none"> • Reduced direct spending on computing capacity
 Gaming and Social Media	\$10-20	Low-latency connection for responsiveness, including rich media and video interactions	<ul style="list-style-type: none"> • Reduced transportation costs • Reduced direct spending on interactive media and communication
 Two-Way Video Streaming	\$150-200	Low-latency video interaction	<ul style="list-style-type: none"> • Reduced transportation costs for personal and family visits, etc.
Total Possible Benefit of High Speed Broadband	\$605-825		

Using the estimated annual household benefit per use case, Cartesian then calculated the average annual household benefit from each broadband technology based on which technologies could deliver the bandwidth for each use case (*see Figure 2*).³⁰ Thus, for example fiber has an estimated annual household benefit of \$800-825 because “[a]ll-fiber connections provide reliable symmetrical gigabit capability, with as much throughput as is needed for all the use cases.”³¹ Conversely, baseline satellite service has an estimated annual household benefit of \$100-125 because “[s]atellite connections are slower, high-latency and are therefore inadequate for many use cases.”³²








²⁹ *Id.*

³⁰ *Id.* at 9.

³¹ *Id.*

³² *Id.*

Figure 2: Monetary Benefits by Technology³³

	<i>Estimated Benefit</i>	<i>Comment</i>
 Fiber	\$800-825	All-fiber connections provide reliable symmetrical gigabit capability, with as much throughput as is needed for all the use cases
 Cable	\$625-675	Cable connections can reach similar downstream speeds as all-fiber, but often experience slower upstream speeds, affecting the user experience for use cases like gaming, 2-way video and telecommuting
 Baseline DSL	\$250-300	DSL connections are distance sensitive, and thus in rural areas, they are typically too slow for quality experience in video-related use cases, such as telecommuting, 2-way video, consumer video, and remote health and learning
 Minimum DSL	\$175-200	
 Fixed Wireless	\$200-250	Fixed wireless connections are distance sensitive and have variable coverage and reliability, based on terrain and other factors, and thus many fixed wireless users cannot attain most of the benefits from remote work or 2-way video
 Baseline Satellite	\$100-125	Satellite connections are slower, high-latency and are therefore inadequate for many use cases
 Minimum Satellite	\$50-100	

Cartesian next mapped the benefits by technology to the performance tiers in the CAF II auction based on the anticipated bidding participation mix of each technology per tier using data from past auctions (*see Figure 3*).³⁴ For example, 80% of bids in the gigabit tier came from fiber providers and 20% from cable providers, making \$780 the average annual benefit per household for service provided in that tier.³⁵

³³ *Id.*

³⁴ *Id.* at 10.

³⁵ *Id.*

Figure 3: Monetary Benefits by Service Tier³⁶

Estimated Current Annual Benefits by Service Tier	
Gigabit, Low Latency	\$780.00
Above Baseline, Low Latency	\$650.00
Baseline, Low Latency	\$248.75
Minimum, Low Latency	\$202.50
Baseline, High Latency	\$112.50
Minimum, High Latency	\$75.00

To determine the discount by performance tier, Cartesian applied the estimated benefits per service tier to a weighting formula that allocated support for each tier and latency level proportionally to the benefits of the gigabit tier.³⁷ The formula is as follows:

$$\text{Weight} = 100 \times (100\% - (\text{Service Tier Benefit} / \text{Gigabit Benefit}))$$

where 100% represents the maximum possible benefit.³⁸ Thus, the discount for the baseline low latency tier was calculated as follows:

$$100\% - (\$249 / \$780) = 100\% - 31.9\% = 68.1\% \approx 70$$

The full set of discounts calculated by Cartesian are represented in *Figure 4*, which also shows the CAF II and proposed RDOF discounts for comparison.

³⁶ *Id.*

³⁷ *Id.* at 11.

³⁸ *Id.*

Figure 4: Weighting Methodologies³⁹

Service Tier	CAF II Weights	FCC's Proposed RDOF Weights	Cartesian Weights
Gigabit Low Latency	0	0	0
Above Baseline Low Latency	15	25	15
Baseline Low Latency	45	50	70
Baseline High Latency	70	90	85

The Cartesian study presents a non-arbitrary methodology that maximizes the Commission's budget. By setting discounts based on the relative benefit received at each performance tier, Cartesian concluded that its "recommended weights are expected to encourage increased bidding—especially among high performance gigabit providers—which would make the auction more competitive."⁴⁰ The increased competition would, in turn, drive down prices, which will free up funds to provide service to more locations.

The outcome of an auction using the Cartesian discounts will also serve to close the digital divide and ensure that rural Americans keep pace with their urban counterparts. As Cartesian concluded, the recommended weights will "ensure the greatest number of unserved households are connected with high speed broadband"⁴¹ because it will increase the chances that higher speed, lower latency services can make winning bids. Those higher-tier services will allow rural Americans to access all the benefits that Cartesian identified in its study, particularly those that are "critical to economic opportunity, job creation, education and civic

³⁹ *Id.* at 12; NPRM at ¶ 25.

⁴⁰ Appendix A: Cartesian Weighting Study at 2.

⁴¹ *Id.*

engagement”⁴²—namely, telecommuting, remote health and learning, and e-commerce—but that are not viable use cases in baseline tiers.⁴³ Additionally, winning gigabit deployments will prevent rural Americans from falling behind because they can provide speeds to meet consumer demand well-beyond the 10-year support term.

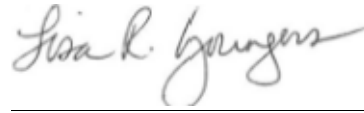
CONCLUSION

Through the RDOF auction, the Commission seeks to maximize its limited budget and support deployments that reflect its preference for higher speeds, higher usage allowances, and low latency, which will serve to close the digital divide. By analyzing the participation in and results of the CAF II auction, Cartesian was able to develop a non-arbitrary weighting methodology to determine performance tier discounts based on the relative benefits of each tier, which is substantially greater for gigabit services, when compared to lower speed and higher latency services. Based on this methodology, Cartesian determined that the discount from the gigabit tier to the baseline low latency tier should be 70 points and the discount to the baseline high latency tier should be 85 points. Cartesian concluded that these discounts will maximize participation, the Commission’s budget, and the deployment of gigabit services, allowing rural Americans to take advantage of critical benefits and preventing them from falling behind their urban counterparts. For these reasons, the Commission should adopt the discounts produced by the non-arbitrary Cartesian methodology detailed above.

⁴² NPRM at ¶ 1.

⁴³ Appendix A: Cartesian Weighting Study at 8-9.

Respectfully Submitted,

A handwritten signature in cursive script, reading "Lisa R. Youngers".

Lisa R. Youngers
President and CEO
Fiber Broadband Association
Suite 800
2025 M Street NW
Washington, DC 20036
Telephone: (202) 367-1236

September 20, 2019

Appendix A

Reverse Auction Weighting Methodology

Analysis and Recommendations

September 20, 2019

Prepared for:  **Fiber
Broadband**
ASSOCIATION



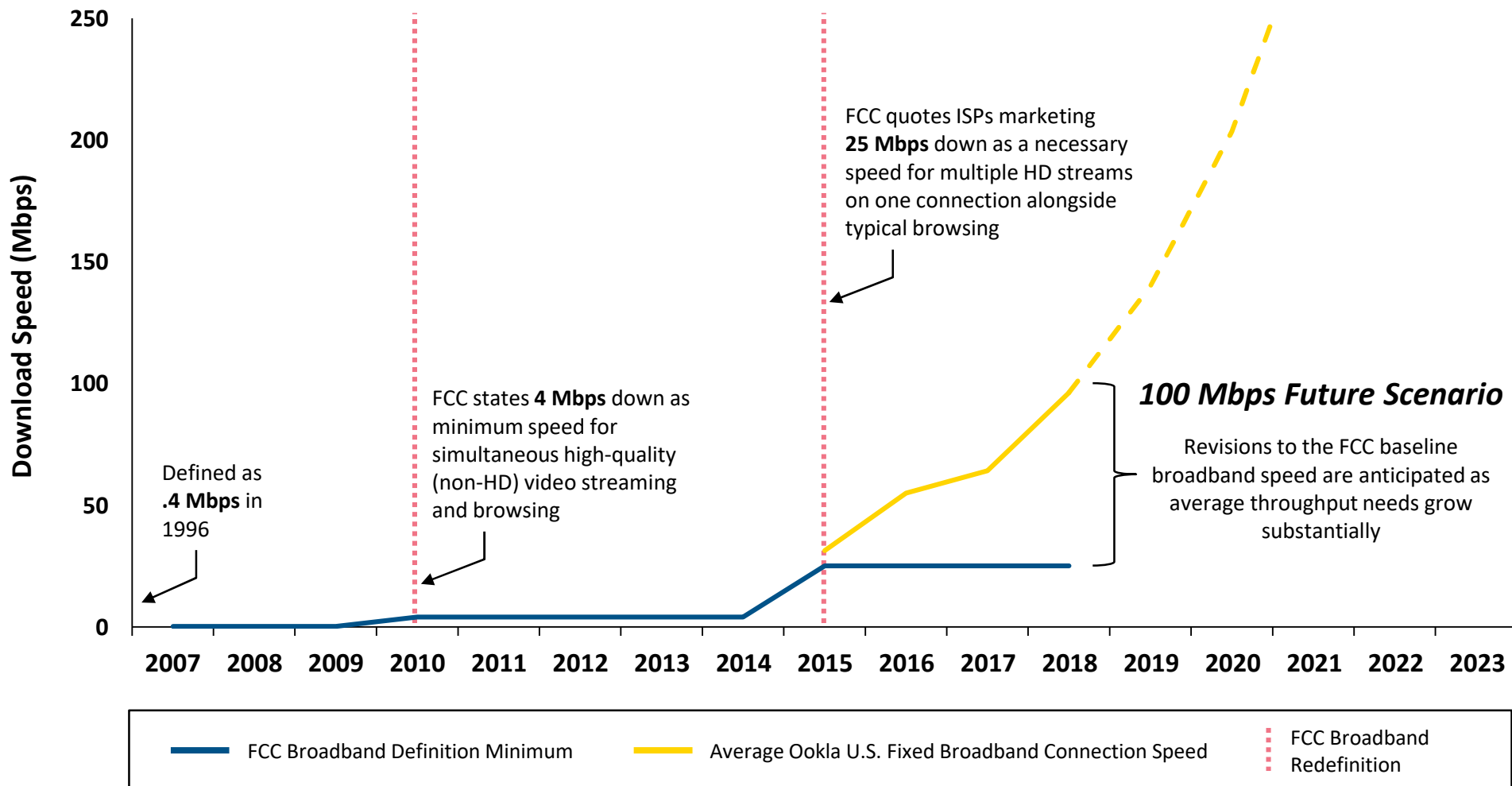
Executive Summary

The FCC will soon begin the process of allocating support for providers to bring broadband connectivity to millions of unserved locations over the next decade

- ▶ The FCC's objective is "to balance its preference for higher-quality services with its objective to use the finite universal service budget effectively." (FCC Order on Reconsideration Jan. 2018)
- ▶ In the 2018 CAF Phase II auction, the FCC employed a set of weights designed to discount bids for lower performance broadband technologies and efficiently deploy \$1.98 billion of budgeted support to the greatest number of unserved households
- ▶ We find that the weights did not maximize participation in the auction, especially from providers that could offer the highest performance gigabit service, and thus did not distribute support most efficiently
- ▶ We conducted a bottom-up analysis to determine a revised set of weights that scale by the amount of tangible socioeconomic benefits associated with each connection technology
- ▶ Our recommended weights are expected to encourage increased bidding – especially among high performance gigabit providers – which would make the auction more competitive
- ▶ Our weights also should produce results that provide consumers with greater tangible benefits while maximizing the use and efficiency of limited universal service support to ensure the greatest number of unserved households are connected with high speed broadband

FCC Definition of Baseline Broadband Service

The FCC periodically redefines the baseline broadband speed – given market trends, we expect an upgrade to 100Mbps¹ in the near future



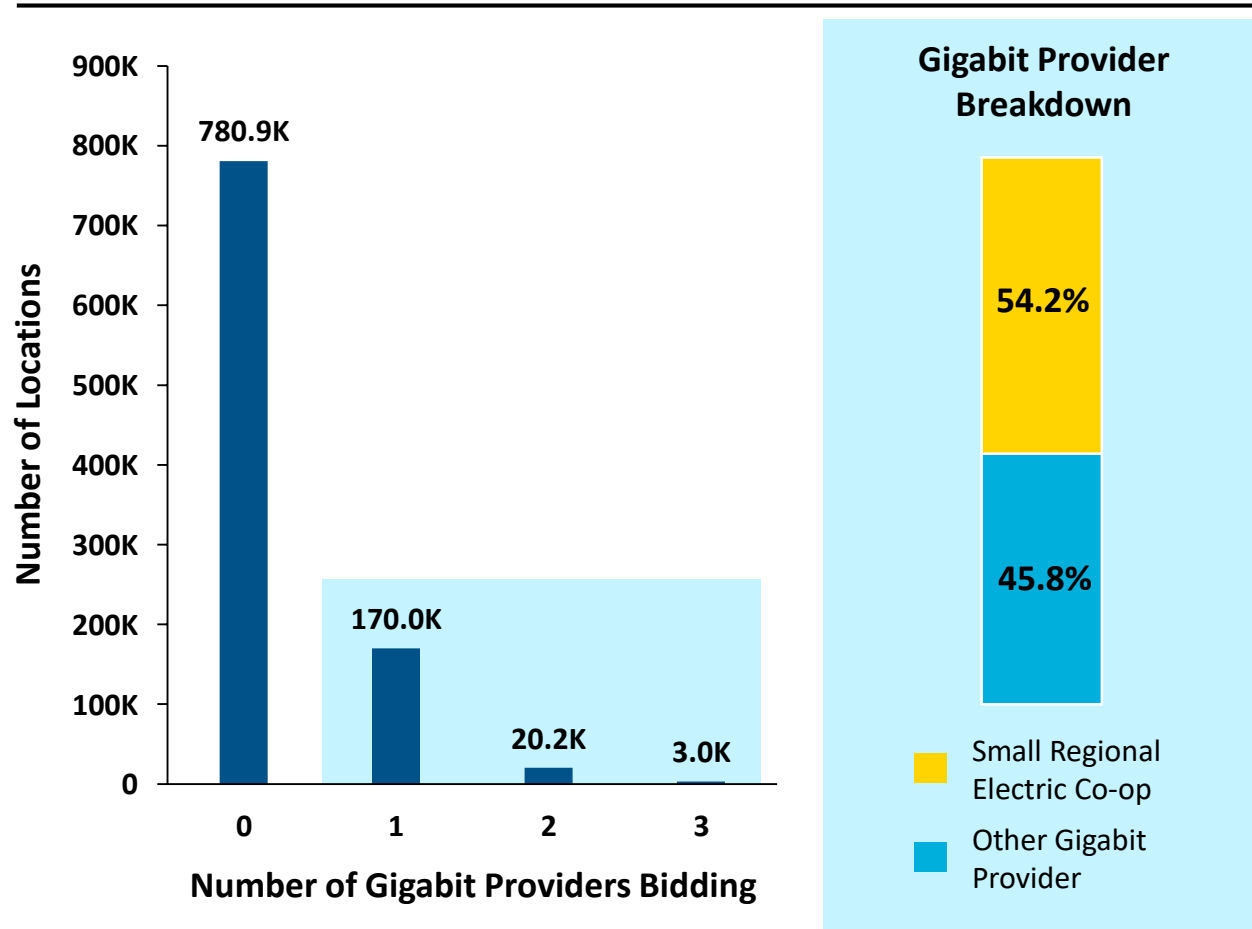
¹ 100Mbps is the maximum downstream speed of VDSL2 (without bonding) and DOCSIS 2.0, and falls within a reasonable range of future estimates of aggregate speed

Source: Cartesian, FCC, Akamai

CAF Phase II Auction 903 Gigabit Participation

Despite rapidly growing demand for high speeds, the weights used by the FCC in its CAF Phase II auction did not encourage meaningful participation by providers offering gigabit services

Gigabit Bidder Analysis



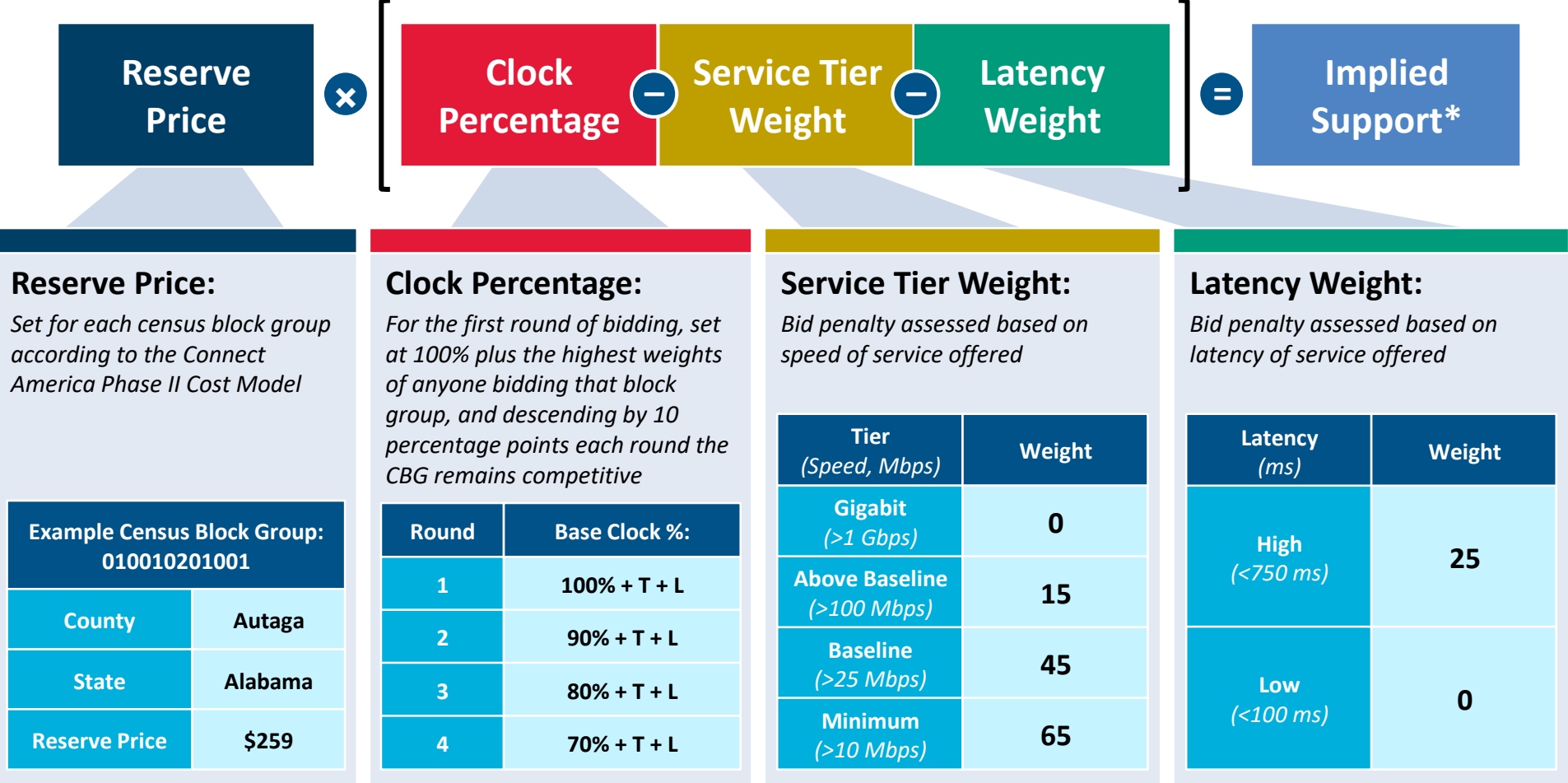
Comments

- Few areas saw gigabit bids, and no areas saw bids from more than 3 gigabit providers
- Many of the gigabit bidders were regional electric co-ops, who had unique viable business cases because of synergies with existing networks and service footprints
- Increased participation by other gigabit providers would likely have pushed down ultimate support levels for many locations, thereby increasing the number of locations that can be served within the budget
- More participation would have a spill-over effect as providers move to expand new locations that are near-network and viable to win

A new weighting methodology should better assess the relative benefits of technologies at each performance tier

Recap: FCC CAF Phase II Auction 903

The FCC allocated the CAF Phase II budget by using a descending clock auction for each census block group it offered



Providers keep bidding for a census block group until the implied support drops below what they are willing to receive to connect locations there – a block is won when only one provider remains

* Capped at reserve price for a CBG
 Source: Cartesian, FCC
 Confidential and Proprietary — Copyright © 2019 Cartesian, Inc. All rights reserved.

Recap: Bid Example

We have outlined an example CAF auction round with four illustrative bidders dropping off on different rounds depending on their desire to accept support at that level

Example CBG 340297202021; Ocean County, NJ: Reserve Price = \$443

ILLUSTRATIVE

Round (Clock %)	Provider A Gigabit low latency (0 weight)	Provider B Above baseline low latency (15 tier weight)	Provider C Baseline low latency (45 tier weight)	Provider D ¹ Minimum high latency (65 tier + 25 latency weight)
1 (190%) ¹	$(190 - 0)\% * \$443 \rightarrow \443^2	$(190 - 15)\% * \$443 \rightarrow \443^2	$(190 - 45)\% * \$443 \rightarrow \443^2	$(190 - 90)\% * \$443 \rightarrow \443
2 (180%)	$(180 - 0)\% * \$443 \rightarrow \443^2	$(180 - 15)\% * \$443 \rightarrow \443^2	$(180 - 45)\% * \$443 \rightarrow \443^2	$(180 - 90)\% * \$443 \rightarrow \399
9 (110%)	$110\% * \$443 \rightarrow \443^2	$95\% * \$443 \rightarrow \421	$65\% * \$443 \rightarrow \289	$20\% * \$443 \rightarrow \89
10 (100%)	$100\% * \$443 \rightarrow \443	$85\% * \$443 \rightarrow \377	$55\% * \$443 \rightarrow \244	N/A
11 (90%)	$90\% * \$443 \rightarrow \399	N/A	$45\% * \$443 \rightarrow \199	N/A
12 (80%)	N/A	N/A	$35\% * \$443 \rightarrow \155	N/A
<i>Final losing bid³</i>	<i>Final winning bid</i>	Provider C wins the census block group		

The FCC's overarching objective is to deploy high-performance broadband to unserved locations within its limited support budget

¹ Set at 190 since the highest weight of a bidder is 90 (Provider D).

² Implied support capped at reserve price of \$443.

³ The provider stopped bidding after this round because the amount of support implied by its bid in the next round would have been too low.

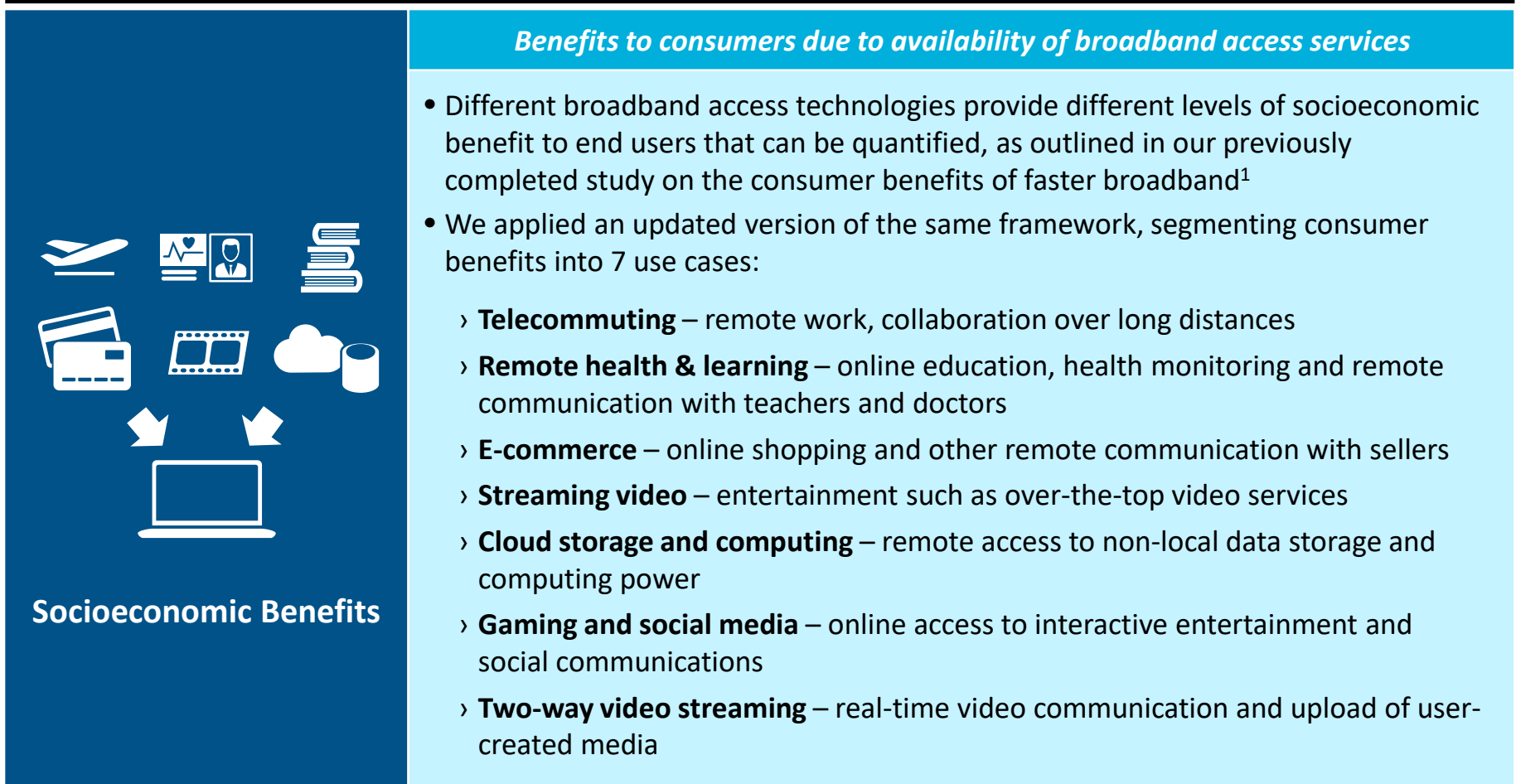
Source: Cartesian, FCC

Confidential and Proprietary — Copyright © 2019 Cartesian, Inc. All rights reserved.

Bottom-up Analysis to Determine Auction Weights

We propose a bottom-up weighting methodology that takes into account tangible socioeconomic benefits produced by different access technologies

Delivery Technology Aspects










¹ The study assessed the Australian NBN plan for deploying 25Mbps access speeds to all households: http://neoconnect.us/wp-content/uploads/2015/09/National_Broadband_Plan_Policy_Evaluation.pdf

Source: Cartesian, FCC

Estimated Savings by Use Case

Different use cases bring on different amounts of monetary benefit

Use Case	Est. Annual Benefit / HH*	Connectivity Needs	Sources of Benefit
 Telecommuting**	\$250-300	Efficient collaboration and low-latency video conferencing	<ul style="list-style-type: none"> • Savings on fuel, vehicle and other transportation costs • Reduced facilities costs
 Remote Health & Learning**	\$50-100	Video conferencing with doctor/instructor, web-based tools and applications	<ul style="list-style-type: none"> • Savings on transportation • Reduced direct costs of doctor visits • Reduced educational housing costs
 E-Commerce**	\$100-120	Research, comparison shopping and purchasing, including video reviews	<ul style="list-style-type: none"> • Time and cost savings for purchasing decisions • Reduced transportation costs
 Streaming Video	\$20-50	Standard definition and 4K video streaming for entertainment	<ul style="list-style-type: none"> • Reduced transportation costs • Reduced direct spending on video entertainment
 Cloud Storage and Computing	\$20-30	Storage, file syncing, and throughput for remote machine use	<ul style="list-style-type: none"> • Reduced direct spending on computing capacity
 Gaming and Social Media	\$10-20	Low-latency connection for responsiveness, including rich media and video interactions	<ul style="list-style-type: none"> • Reduced transportation costs • Reduced direct spending on interactive media and communication
 Two-Way Video Streaming	\$150-200	Low-latency video interaction	<ul style="list-style-type: none"> • Reduced transportation costs for personal and family visits, etc.
Total Possible Benefit of High Speed Broadband	\$605-825		

*Assumed to be the maximum benefit that could be unlocked when broadband speeds are not a constraint on the use case








**Especially important in rural areas to drive commerce and jobs.

Source: Cartesian, FCC

Confidential and Proprietary — Copyright © 2019 Cartesian, Inc. All rights reserved.

Benefit Detail

Using estimated benefits per use case, we scored each access technology on its suitability, and quantified total benefits per access tech

	<i>Estimated Benefit</i>	<i>Comment</i>
 Fiber	\$800-825	All-fiber connections provide reliable symmetrical gigabit capability, with as much throughput as is needed for all the use cases
 Cable	\$625-675	Cable connections can reach similar downstream speeds as all-fiber, but often experience slower upstream speeds, affecting the user experience for use cases like gaming, 2-way video and telecommuting
 Baseline DSL	\$250-300	DSL connections are distance sensitive, and thus in rural areas, they are typically too slow for quality experience in video-related use cases, such as telecommuting, 2-way video, consumer video, and remote health and learning
 Minimum DSL	\$175-200	
 Fixed Wireless	\$200-250	Fixed wireless connections are distance sensitive and have variable coverage and reliability, based on terrain and other factors, and thus many fixed wireless users cannot attain most of the benefits from remote work or 2-way video
 Baseline Satellite	\$100-125	Satellite connections are slower, high-latency and are therefore inadequate for many use cases
 Minimum Satellite	\$50-100	








Note: All dollar amounts per subscriber per year.

Source: Cartesian, FCC

Confidential and Proprietary — Copyright © 2019 Cartesian, Inc. All rights reserved.

Mapping of Broadband Access Tech to Auction Service Tiers

Resulting socioeconomic effectiveness per broadband access medium was mapped to FCC defined service tiers based on the participating mix of technologies per tier in past auctions

Current Annual Benefits by Broadband Access Medium*		Estimated Current Annual Benefits by Service Tier	
 Fiber	\$812.50	Gigabit, Low Latency	\$780.00
 Cable	\$650.00	Above Baseline, Low Latency	\$650.00
 Baseline DSL	\$275.00	Baseline, Low Latency	\$248.75
 Minimum DSL	\$187.50	Minimum, Low Latency	\$202.50
 Fixed Wireless	\$225.00	Baseline, High Latency	\$112.50
 Baseline Satellite	\$113.00	Minimum, High Latency	\$75.00
 Minimum Satellite	\$75.00		

Service Category	Fiber	Cable	Baseline DSL	Minimum DSL	Fixed Wireless	Baseline Satellite	Minimum Satellite
Gigabit, Low Latency	80%	20%	-	-	-	-	-
Above Baseline, Low Latency	-	100%	-	-	-	-	-
Baseline, Low Latency	-	5%	5%	-	90%	-	-
Minimum, Low Latency	-	-	-	60%	40%	-	-
Baseline, High Latency	-	-	-	-	-	100%	-
Minimum, High Latency	-	-	-	-	-	-	100%

- Attribution percentages estimated based on anticipated mix of broadband technologies to be engaged in bidding process
- Takes into account results from previous auction

* Taken as midpoint of range of benefits.

Source: Cartesian, FCC

Confidential and Proprietary — Copyright © 2019 Cartesian, Inc. All rights reserved.

Weight Calculation Methodology

We employed a methodology to derive weights based on benefits brought on by access service tier and latency

Weight Calculation Methodology

100

×

100%

-

Service Category Benefit

÷

Gigabit Benefit

=

Service Category Weight

Example Weight Calculation: Baseline, Low Latency

Current Annual Benefits by Service Tier	
Gigabit, Low Latency	\$780
Above Baseline, Low Latency	\$650
Baseline, Low Latency	\$249
Minimum, Low Latency	\$203
Baseline, High Latency	\$113
Minimum, High Latency	\$75

\$249

÷

\$780

=

31.9%

100%

-

31.9%

=

68.1%

Baseline, Low Latency Service Category Weight

70

Our weightings allocate support in any specific round of the auction proportionally to the benefits of that combination of tier and latency compared to gigabit

New Weightings

We based new suggested weightings on the relative amount of benefit created by each service category – this ensures that the ratio of support to benefit is constant across technologies

Service Category	FCC Weights	Cartesian-Modified Weights	Comments
Gigabit, Low Latency	0	0	Weights for gigabit and above baseline service did not change, reflecting their high amounts of consumer benefit
Above Baseline, Low Latency	15	15	
Baseline, Low Latency	45	70	Given the significantly lower consumer benefit provided by technologies relative to gigabit and above baseline speeds, previous weights were too low – the updated weights more accurately reflect the discrepancy in consumer benefit contribution
Minimum, Low Latency	65	75	
Baseline, High Latency	70	85	The FCC’s weightings did not go far enough in penalizing baseline-level satellite providers, given that they do not enable many use cases necessary in the next 10 years – the penalty is now closer to that of the minimum satellite tier
Minimum, High Latency	90	90	

Further analysis can predict the impact of these weights on the prior auction and determine whether further adjustments would be needed



BOSTON

KANSAS CITY

LONDON

NEW YORK

PARIS